

REMARKS

Claims 33-64 are pending, with claims 33-50 under current examination and claims 51-64 withdrawn from consideration. By this Amendment, Applicants have amended claims 33 and 56 solely to correct a typographical error, and claims 45 and 49 to overcome an objection.

Office Action:

Applicants respectfully traverse the following objections and rejections:

- (a) objection to the Abstract and the Title;
- (b) objection to claims 45 and 49;
- (c) rejection of claims 33-50 under 35 U.S.C. § 103(a) as being unpatentable over Kim et al., “Cu-Ni Cermet Anodes for Direct Oxidation of Methane in Solid-Oxide Fuel Cells” (“Kim”) in view of U.S. Patent No. 4,423,122 (“Iacovangelo”);
- (d) rejection of claim 48 under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Iacovangelo and further in view of U.S. Patent App. Pub. No. 2002/0061429 (“Batawi”); and
- (e) rejection of claim 49 under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Iacovangelo and further in view of Livermore et al., “Fuel Reforming and Electrical Performance Studies in Intermediate Temperature Ceria-Gadolinia-Based SOFCs” (“Livermore”).

Objection to the Abstract and Title:

Without agreeing with the Office Action’s objection to the Abstract, Applicants have amended the Abstract as presented herein, with support being drawn from claim 33, and the specification at p. 3, lines 14-16. Moreover, without agreeing with the Office Action’s objection to the Title, Applicants have amended the Title as presented herein. Accordingly, Applicants request withdrawal of the objection.

Objection to Claims 45 and 49:

The Office Action objected to claims 45 and 49, indicating that “all parentheses[e] should be removed for better understanding of the claims. Appropriate correction is required.” Office Action, p. 3. Applicants disagree, noting that the portions of claims 45 and 49 in parentheses are

merely acronyms for different claimed ceramic compounds, which are used in the specification and are generally recognized in the pertinent art. Nevertheless, to advance prosecution, Applicants have amended claims 45 and 49 to delete the portions in parentheses. Accordingly, Applicants request withdrawal of the objection.

Rejection of Claims 33-50 under 35 U.S.C. § 103(a):

Applicants request reconsideration and withdrawal of the rejection of claims 33-50 under 35 U.S.C. § 103(a) as being unpatentable over Kim in view of Iacovangelo.

The Office Action has not properly resolved the *Graham* factual inquiries, the proper resolution of which is the requirement for establishing a framework for an objective obviousness analysis. See M.P.E.P. § 2141(II), citing to *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), as reiterated by the U.S. Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007). No *prima facie* case of obviousness has been established with respect to these claims for at least the reason that the cited references, taken alone or in combination, do not teach or suggest each and every claim element of independent claim 33. The burden thus remains with the Examiner.

Particularly, the Office Action has not properly determined the scope and content of the prior art, at least because the Office Action incorrectly interpreted the content of Kim and Iacovangelo. In addition, the Office Action has not properly ascertained the differences between the claimed invention and the prior art, at least because the Office Action has not properly interpreted the prior art by considering both the invention and the prior art as a whole. See M.P.E.P. § 2141(II)(B).

Kim and Iacovangelo, taken alone or in combination, do not disclose or suggest at least Applicants' claimed "anode comprising a ceramic material and an alloy comprising nickel and at least a second metal selected from aluminum, titanium, molybdenum, cobalt, iron, chromium,

copper, silicon, tungsten and niobium, said alloy having an average particle size not higher than 20 nm,” as recited in independent claim 33.

While the Office Action admits that Kim does not “expressly disclose the specific particle size of both the alloy and the ceramic material [or] the mean surface area,” it improperly piles inference upon inference in alleging that the claimed particle size would have been “obvious” or “inherent.” *See* Office Action, p. 5, and pp. 6-7. This compounding of inferences is incorrect.

Concerning Kim, there is no teaching or any suggestion that a specific combination of the claimed anode materials with a specific average particle size of the alloy of the anode of the solid oxide fuel cell would have any effect on the fuel cell. On the contrary, since at the time the application was filed, there was a *diffused technical prejudice* according to which by reducing the average particle size, the catalytic activity of the undesired side reactions would have been increased and thus the performances of the fuel cells reduced. *See, e.g.,* Applicants’ specification at, for example, p. 3, ll. 19-22. Thus, neither Kim nor any hypothetical person of ordinary skill in the art would have tried to reduce the average particle size to that which is claimed.

Thus, according to the claimed fuel cell, it is possible to obtain a solid oxide fuel cell (1) with high efficiency, (2) over time, (3) in a wide range of temperatures, and (4) when fed with different fuels. In contrast, Kim states at p. A248, second column, last lines, that different results, in terms of efficiency, are achieved by using different fuels (H₂ vs. CH₄). Moreover, by using the method taught by Kim, a significant carbon deposition is obtained, as shown both in Fig. 1 and in Table 1. Thus the performance of the cell during time is significantly reduced.

In sharp contrast, due to the claimed average particle size of the alloy of the anode of the fuel cell recited in claim 33, it is possible to avoid carbon deposition, even in the same time

interval and at the same temperature as those used by Kim, as demonstrated by the examples and as explained in the specification at, for example, p. 18, ll. 7-17. It is only by providing a solid oxide fuel cell with the claimed combination of features that it is possible to achieve a significant reduction of, or even to avoid, carbon formation on the anode.

Iacovangelo does not cure the deficiencies of Kim. Iacovangelo is concerned with a very different technical problem, i.e. the difficulty in fabricating single metal plated powders into porous sintered electrode structures. *See, e.g., Iacovangelo*, col. 1, ll. 12-23. Moreover, even if Iacovangelo individuates a ceramic particle size range particularly suitable for solving such a problem, said range is very different from the claimed range. As a matter of fact, claim 33 recites an average particle size not higher than 20 nm, while Iacovangelo instead teaches using a ceramic particles size ranging from 0.1 micron to about 20 microns, that is, from 100 nm to 20,000 nm.

Accordingly, even combining the teaching of Kim with the teaching of Iacovangelo, one of ordinary skill in the art would have not obtained the claimed solid oxide fuel cell, but rather an inferior fuel cell, i.e., one with much higher average particle size, which therefore does not solve the technical problem solved by the present invention. Instead, the claimed invention reduces the average particle size of particles constituting the alloy of the anode, as explained, for example, on p. 3, ll. 12-22 of the specification.

Turning to the Examiner's broad allegations, Applicants address five main points raised in the Office Action:

- (1) "the particle size of the nickel-copper alloy encapsulated ceramic particle material is taken to represent the particle size of both the alloy and the ceramic material as Iacovangelo et al does not appear to make a distinction between one and the other."
Office Action, p. 5.

(2) “the mean surface area is considered to be an inherent characteristic or property present in the combined teachings of the prior art.... Accordingly, products of identical composition cannot have mutually exclusive properties, and thus, the claimed property, is necessarily present in the prior art material.” *Id.* (citation to *In re Spada* omitted).

(3) “[g]enerally speaking, differences in sizes or dimension will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such size or dimension is critical.” *Id.* at 6 (citation to *In re Aller* omitted).

(4) “it is prima facie obvious to choose or select the specific particle size of the alloy and the ceramic material.” *Id.* (citation to M.P.E.P. § 2144.05 omitted).

(5) “limitations relating to the size of the feature, article, element, or member are not sufficient to patentably distinguish over the prior art as it is noted that changes in size [are] a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular size of the claimed particle is significant.” *Id.* at 6-7 (citations to *In re Rose*, *In re Rinehart*, *In re Gardner*, and M.P.E.P. § 2144.04 omitted).

Regarding points (1) and (2), Applicants note that “[o]bviousness cannot be predicated on what is not known at the time an invention is made, even if the inherency of a certain feature is later established.” M.P.E.P. § 2141.02(V). Applicants dispute the Office Action’s allegations of inherency, and submit that the Office Action relies on improper hindsight reasoning, or compounding of inferences, to support the rejection.

Regarding points (3) and (4), the Office Action misapplies M.P.E.P. § 2144.05 and *In re Aller*. Particularly, regarding the optimization of ranges discussed in M.P.E.P. § 2144.05(II)(A) and (B), the holding of *In re Aller* does not apply in the context of this rejection.

Citing *In re Aller*, the M.P.E.P. states: “Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical.” M.P.E.P. § 2144.05(II)(A). In *In re Aller*, the court presumed that changes in concentration and

temperature in an organic synthesis context can be optimized without undue experimentation. This is a rebuttable presumption, and was applied in *In re Aller* only to concentration and temperature ranges in the organic chemistry arts in which *In re Aller* was interested. The Office Action, however, has not cited any evidence, scientific or legal, to show that any such presumption exists in the electrical or materials arts regarding Applicants' claimed "alloy having an average particle size not higher than 20 nm," as recited in claim 33.

It is clear that the *In re Aller* presumption, discussed in M.P.E.P. § 2144.05(II)(A) and (B), does not apply to the present situation. Moreover, even if *In re Aller* did apply, the court subsequently recognized two exceptions in *In re Antonie*, 559 F.2d 618 (CCPA 1977). See also M.P.E.P. § 2144.05(II)(B). The M.P.E.P. clearly states the first exception: "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie* [] ... See also *In re Boesch* []." M.P.E.P. § 2144.05(II)(B) (internal citations omitted, emphasis added). Here, the Examiner has not met his burden of showing that the claimed "alloy having an average particle size not higher than 20 nm" (claim 33) would have been recognized by those of ordinary skill in the art as a result-effective variable.

Furthermore, the court states the second exception in the last paragraph of *In re Antonie*: "In *In re Aller*, the court set out the rule that the discovery of an optimum value of a variable in a known process is normally obvious. We have found exceptions to this rule in cases where the results of optimizing a variable, which was known to be result effective, were unexpectedly good." *In re Antonie*, 559 F.2d 618, 620, 195 USPQ 6,8-9 (CCPA 1977) (emphasis added, internal citations omitted).

In view of this, Applicants respectfully direct the Examiner's attention to the "particularly surprising" results discussed in the specification at p. 3, lines 12-22, and p. 18, lines 11-17 (noting that operation of the claimed solid oxide fuel cell produced results opposite that of Kim). Thus no one of ordinary skill in the art could have developed Applicants' claimed invention on the basis of Kim, and certainly not without having the benefit of Applicants' specification. Moreover, as discussed above, the Examiner has not met his burden of showing that Applicants' claimed "alloy having an average particle size not higher than 20 nm" (claim 33) would have been recognized by those of ordinary skill in the art as a result-effective variable. For at least these reasons, it would not have been obvious to one of ordinary skill in the art to optimize such a variable. See M.P.E.P. § 2144.05(II)(B) ("A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation.")

Therefore, in light of the Office Action's admitted deficiencies in Kim, the Office Action has not considered the claimed invention as a whole, and instead broadly rejected the claims with citation to case law that was improperly considered or not considered at all. A detailed study Applicants' claims and specification clearly demonstrates the nonobviousness of claim 33.

Regarding point (5), M.P.E.P. § 2144.04(IV)(A) contradicts the Office Action's citation to *In re Gardner* as applied to the present rejection. Particularly, the Examiner appears to have overlooked the explanation of *In re Gardner* in this section of the M.P.E.P. According to the M.P.E.P., "the Federal Circuit [in *In re Gardner*] held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device." M.P.E.P.

§ 2144.04(IV)(A) (emphasis added). In the present application, Applicants have explicitly noted how the claimed solid oxide fuel cell performs differently than that of Kim. For example, Applicants again respectfully direct the Examiner's attention to the "particularly surprising" results discussed in the specification at p. 3, lines 12-22, and p. 18, lines 11-17 (noting that operation of the claimed solid oxide fuel cell produced results opposite that of Kim).

Finally, regardless of the Office Action's application of Iacovangelo in combination with Kim to illustrate a particle size range "from about 0.1 micron to about 20 microns" (Office Action, p. 5), Iacovangelo does not cure the deficiencies of Kim as to the claimed "alloy having an average particle size not higher than 20 nm," as recited in claim 33. Moreover, the Office Action's application of Iacovangelo as a secondary reference does not counter the reasoning presented above against points (1) through (5) in the Office Action.

Therefore, in light of the deficiencies in Kim, Iacovangelo, and the arguments presented in the Office Action, it is clear that there is no evidence that one of ordinary skill in the art could or would have developed Applicants' claimed invention solely from the teachings of Kim and Iacovangelo, with or without the knowledge available at the time of the present invention and the inferences drawn therefrom.

Thus, the Office Action has neither properly determined the scope and content of the prior art, nor properly ascertained the differences between the claimed invention and the prior art. No *prima facie* case of obviousness has been established and therefore the burden thus remains with the Examiner.

Independent claim 33 is therefore not obvious over Kim and Iacovangelo. Independent claim 33 should therefore be allowable. Dependent claims 34-50 should also be allowable at least by virtue of their dependence from base claim 33, and because they recite additional

features not taught or suggested by Kim and Iacovangelo. Applicants therefore respectfully request the withdrawal of the 35 U.S.C. § 103(a) rejection.

Remaining Rejections of the Dependent Claims under 35 U.S.C. § 103(a):

Applicants respectfully request reconsideration and withdrawal of the remaining rejections of dependent claims 48 and 49 under 35 U.S.C. § 103(a) over Kim in view of Iacovangelo and further in view of one or more of secondary references Batawi and Livermore.

In the remaining rejections, the Office Action does not assert that Kim in view of Iacovangelo renders obvious Applicants' dependent claims 48 and 49. The Office Action's citations to secondary references Batawi and Livermore, whether taken alone or in any combination with Kim and Iacovangelo, do not remedy the deficiencies of Kim and Iacovangelo as to the recitations of independent claim 33. That is, none of the secondary references teaches or suggests the previously-quoted elements of Applicants' independent claim 33. The Office Action has therefore neither properly determined the scope and content of the prior art nor properly ascertained the differences between the prior art and the claimed invention.

Thus, for at least the above reasons, independent claim 33 is not obvious over Kim and Iacovangelo in view of one or more of secondary references Batawi and Livermore, regardless of whether these references are taken alone or in any combination. Claim 33 should therefore be allowable. Dependent claims 48 and 49 should also be allowable at least by virtue of their respective dependence from base claim 33, and because they recite additional features not taught or suggested by the cited references. Accordingly, Applicants respectfully request reconsideration and withdrawal of the remaining 35 U.S.C. § 103(a) rejections.

Conclusion:

Applicants request reconsideration of the application and withdrawal of the rejections. Pending claims 33-50 are in condition for allowance, and Applicants request a favorable action.

The Office Action contains a number of statements reflecting characterizations of the prior art, alleged inferences to be drawn therefrom, case law, and the related claims. Regardless of whether any such statements are identified herein, Applicants decline to automatically subscribe to any such statements or characterizations in the Office Action.

If there are any remaining issues or misunderstandings, Applicants request the Examiner telephone the undersigned representative to discuss them.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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Dated: January 5, 2010

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